

M54824P, M54828P, M54829P

MITSUBISHI (DGT L LOGIC) 3LE D ■ 6249827 0014692 1 ■ MIT3

FREQUENCY COUNTERS WITH 5-DIGIT FLUORESCENT DRIVER

T-45-23-29

DESCRIPTION

The M54824P, M54828P, M54829P are semiconductor I^2L integrated circuits consisting of a 5-digit fluorescent display tube driver counters.

FEATURES

- Direct drive of 5-digit fluorescent display tubes
- Compatible with AM, FM and SW broadcasts
- Compatible with double or single superheterodyne SW broadcasts receivers
- Built-in reference oscillator circuit (5.12MHz)
- Brightness adjustment

APPLICATIONS

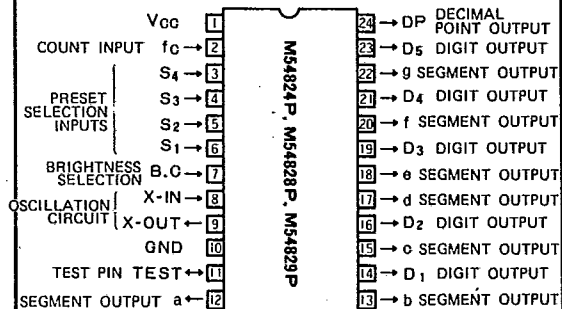
Display of received frequencies in radio receivers; frequency counters in test/measuring instruments.

FUNCTION

By counting the local oscillation frequency of the radio receiver, the M54824P, M54828P, M54829P can display the AM and SW received frequencies in 1kHz units and the FM received frequencies in 0.1MHz units or 10kHz units (FM 2 mode).

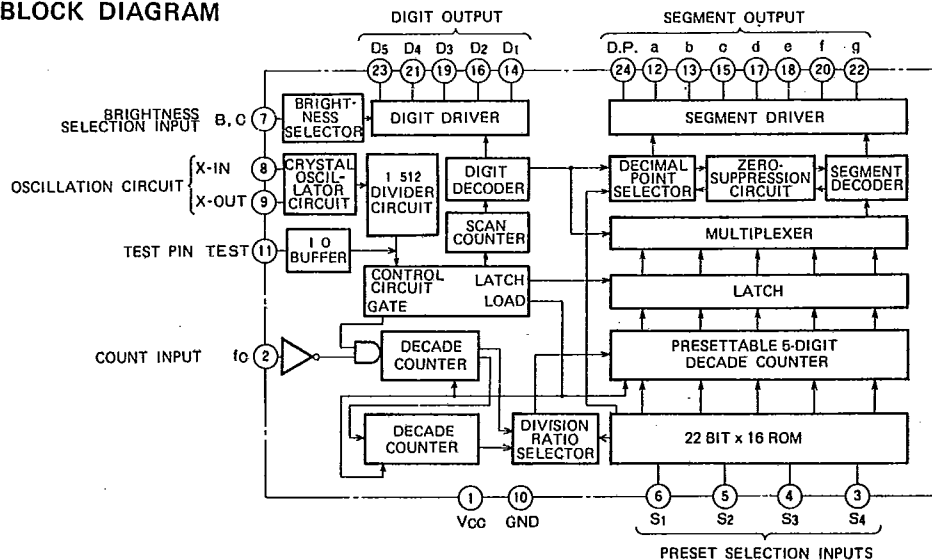
The unit can also be used as a normal frequency counter.

PIN CONFIGURATION (TOP VIEW)



Package Outline 24P4

BLOCK DIAGRAM



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DESCRIPTION OF OPERATION

The functions of the M54828P, M54824P and M54829P are described below.

• Display Modes and Prescaler

Table 1 shows the display modes.

A 1/8 prescaler is required for the AM, SW and counter modes while a 1/80 prescaler is required as an external circuit for the FM and FM 2 modes.

• Preset Values

The preset values are selected from Tables 2 thru 4 in accordance with the intermediate frequency of the radio receiver.

They have the following relationship with the display frequency.

$$\text{Display frequency} = \text{Local oscillation frequency} + \text{Preset value}$$

• Gate Time

The frequency being measured, which is applied to the count input, is counted with an 80ms gate time, and 100ms

are required for a single counting operation period. When a change has been made to the input frequency, the display contents follow with a 10Hz speed.

• Others

Dynamic drive is repeated at a 200Hz frequency and the brightness is varied with the changes in the duty cycles of the digit output.

In order to prevent dual display between the digits, the digit output is such that a blank period is provided before and after the segment changes.

Table 1. Displays in modes

Mode	Display					Unit
SW	X	X.	X	X	X	
FM		X	X	X.	X	
FM2	X	X	X.	X	X	
AM		X	X	X	X	
Counter	X	X	X	X	X	

X : 0~9

Table 2. Preset value selection for M54824P

Mode	Selection input				Preset value		ROM data					Built-in prescaler frequency division ratio
	S ₁	S ₂	S ₃	S ₄		Unit	D ₅	D ₄	D ₃	D ₂	D ₁	
SW	H	L	L	H	— 3	MHz	9	7.	0	0	0	1/10
	L	H	H	H	— 2		9	8.	0	0	0	"
	H	L	H	H	2		0	2.	0	0	0	"
	H	L	L	L	3		0	3.	0	0	0	"
	H	H	L	H	6		0	6.	0	0	0	"
	H	H	H	L	10		1	0.	0	0	0	"
	L	H	H	L	14		1	4.	0	0	0	"
	H	L	H	L	17		1	7.	0	0	0	"
	L	H	L	L	21		2	1.	0	0	0	"
	H	H	L	L	— 455		9	9.	5	4	5	"
AM	H	H	H	H	— 462	kHz	9	9.	5	3	8	"
	L	H	L	H	— 455		9	9	5	4	5	"
FM2	L	L	H	L	— 462	MHz	9	9	5	3	8	"
	L	L	L	L	— 10.7		9	8	9.	3	0	"
FM	L	L	L	H	— 10.7		9	9	8	9.	3	1/100
	L	L	H	H	10.7		0	0	1	0.	7	"

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Table 3. Preset value selection for M54828P

Mode	Selection input				Preset value		ROM data					Built-in prescaler frequency division ratio
	S ₁	S ₂	S ₃	S ₄		Unit	D ₅	D ₄	D ₃	D ₂	D ₁	
SW	H	L	L	H	— 3	MHz	9	7.	0	0	0	1/10
	L	H	H	H	— 2		9	8.	0	0	0	"
	H	L	H	H	2			2.	0	0	0	"
	H	L	L	L	3			3.	0	0	0	"
	H	H	L	H	6			6.	0	0	0	"
	H	H	H	L	10		1	0.	0	0	0	"
	L	H	H	L	14		1	4.	0	0	0	"
	H	L	H	L	18		1	8.	0	0	0	"
	H	H	L	L	21		2	1.	0	0	0	"
AM	L	H	L	L	— 10.7	kHz	8	9.	3	0	0	"
	L	H	L	H	— 455		9	9	5	4	5	"
	L	L	H	L	— 462		9	9	5	3	8	"
	L	L	L	L	— 470		9	9	5	3	0	"
FM	L	L	L	H	— 10.7	MHz	9	9	8	9.	3	1/100
	L	L	H	H	10.7		0	0	1	0.	7	"
Counter	H	H	H	H	0		0	0	0	0	0	1/10

Table 4. Preset value selection for M54829P

Mode	Selection input				Preset value		ROM data					Built-in prescaler frequency division ratio
	S ₁	S ₂	S ₃	S ₄		Unit	D ₅	D ₄	D ₃	D ₂	D ₁	
SW	H	L	L	H	— 3	MHz	9	7.	0	0	0	1/10
	L	H	H	H	— 2		9	8.	0	0	0	"
	H	L	H	H	2			2.	0	0	0	"
	H	L	L	L	3			3.	0	0	0	"
	H	H	L	H	6			6.	0	0	0	"
	H	H	H	L	10		1	0.	0	0	0	"
	L	H	H	L	14		1	4.	0	0	0	"
	H	L	H	L	17		1		0	0	0	"
	H	H	L	L	21		2	1.	0	0	0	"
AM	L	H	L	L	— 10.7	kHz	8	9.	3	0	0	"
	L	H	L	H	— 455		9	9	5	4	5	"
	L	L	H	L	— 462		9	9	5	3	8	"
	L	L	L	L	— 10.70		9	8	9.	3	0	"
FM	L	L	L	H	— 10.7	MHz	9	9	8	9.	3	1/100
	L	L	H	H	10.7		0	0	1	0.	7	"
Counter	H	H	H	H	0		0	0	0	0	0	1/10

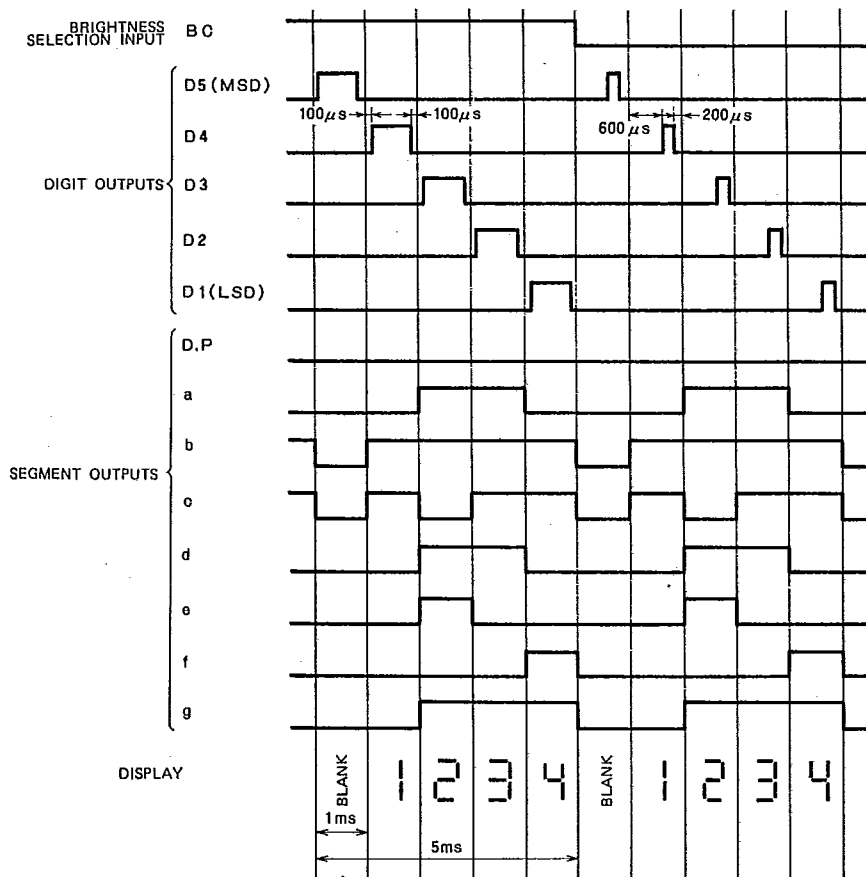
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OUTPUT TIMING DIAGRAM

Shown below is a timing chart when 1234kHz is indicated in the AM mode.



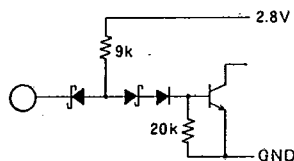
Display element configuration

0123456789

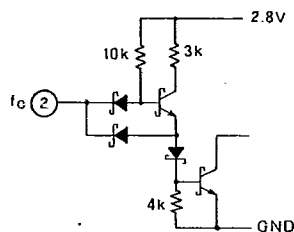


INPUT/OUTPUT CIRCUITS

S1~S4, B C inputs



f_c input

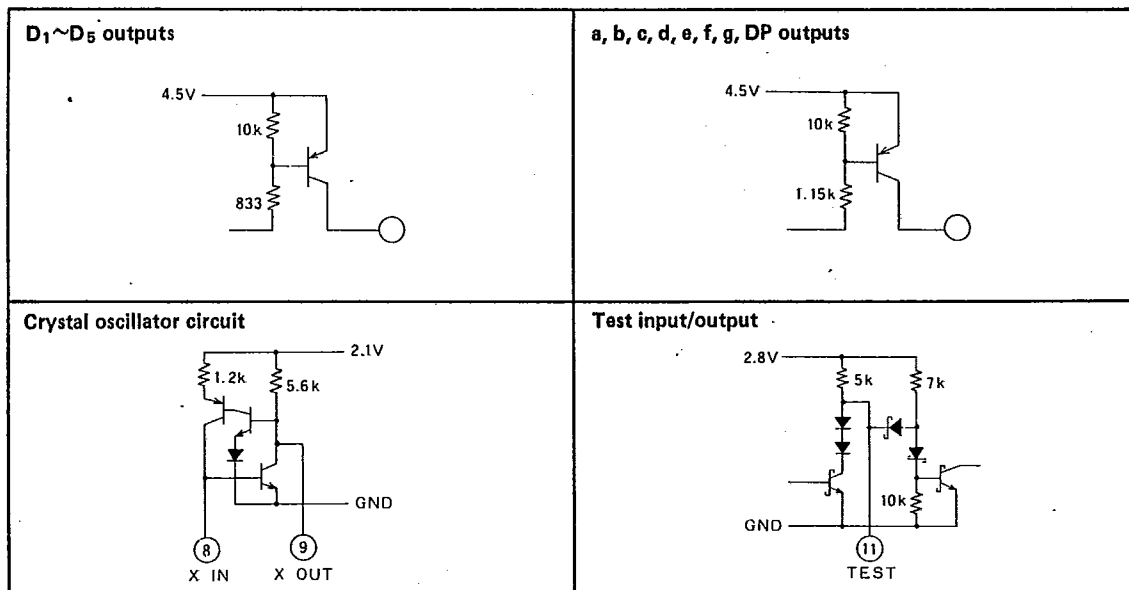


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**ABSOLUTE MAXIMUM RATINGS** ($T_a = -10 \sim +60^\circ\text{C}$, unless otherwise noted)

Symbol	Parameter	Conditions	Limits	Unit
V_{CC}	Supply voltage		$-0.5 \sim +10$	V
V_I	Input voltage (pins 2~7)		$-0.5 \sim V_{CC}$	V
V_O	Output voltage (pins 12~24)		$-22 \sim +4$	V
P_d	Power dissipation		600	mW
T_{opr}	Operating temperature		$-10 \sim +60$	$^\circ\text{C}$
T_{stg}	Storage temperature		$-55 \sim +125$	$^\circ\text{C}$

RECOMMENDED OPERATING CONDITIONS ($T_a = -10 \sim +60^\circ\text{C}$, unless otherwise noted)

Symbol	Parameter	Limits			Unit
		Min	Typ	Max	
V_{CC}	Supply voltage	4	5	7	V
f_o	Count frequency	0	—	4.25	MHz
D_{IN}	Count input duty cycle ($f = f_{omax}$)	45	50	70	%
f_{oso}	Reference oscillation frequency	—	5.12	—	MHz

ELECTRICAL CHARACTERISTICS ($T_a = -10 \sim +60^\circ\text{C}$, unless otherwise noted)

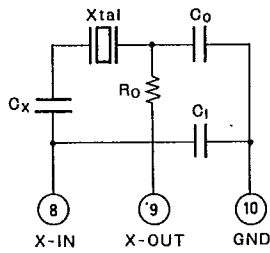
Symbol	Parameter		Test conditions	Limits			Unit
				Min	Typ	Max	
V_{IH}	High-level input voltage			2			V
V_{IL}	Low-level input voltage	Pin 2				0.7	V
		Pins 3~7				0.9	V
I_{IH}	High-level input current		$V_{CC}=7V$			100	μA
I_{IL}	Low-level input current		$V_{CC}=7V$			-400	μA
I_{seg}	Segment current		$V_{CC}=6V, V_O=3V, T_a=25^\circ\text{C}$	-5			mA
I_{dig}	Digit current		$V_{CC}=6V, V_O=3V, T_a=25^\circ\text{C}$	-6			mA
I_{slk}	Segment leakage current		$V_{CC}=7V, V_O=-22V$			-20	μA
I_{dlk}	Digit leakage current		$V_{CC}=7V, V_O=-22V$			-20	μA
I_{CC1}	Circuit current (segment output off)		$V_{CC}=7V$			35	mA
I_{CC2}	Circuit current (segment output on)		$V_{CC}=7V$			60	mA

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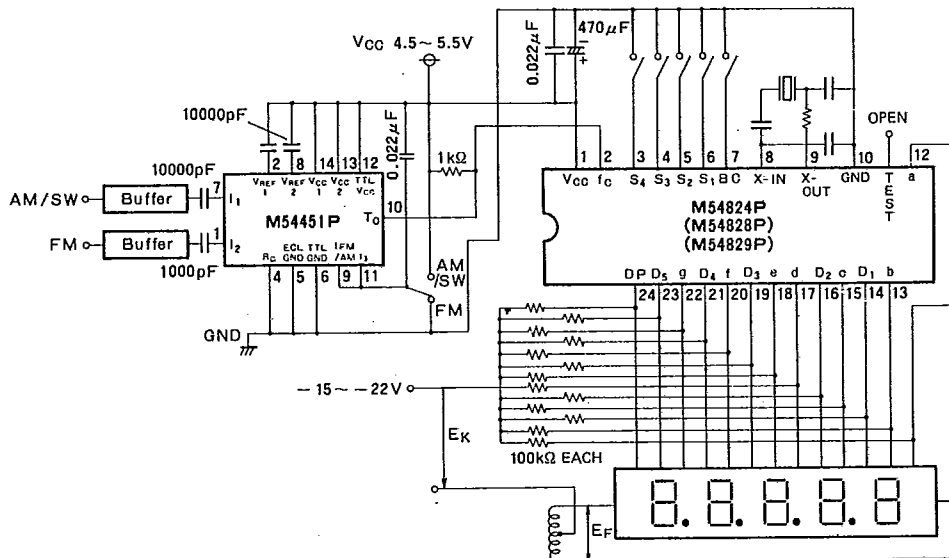
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EXTERNAL CONNECTIONS OF OSCILLATOR CIRCUIT



Xtal : 5.120MHz (70Ω max. equivalent resistance, 32pF load capacitance)
 C_x : 82pF
 C_i : 270pF
 C_o : 68pF
 R_o : 330Ω

APPLICATION EXAMPLE



E_F: AC 2~3V filament voltage
 E_K: 4V cathode cut-off bias

Fluorescent display tube: 5-BT-11/5-BT-05 (by Futaba Electronics)